Instructions for Using ENERGY STAR® Builder Option Packages

Builder Option Packages (BOPs) are a prescriptive method for labeling new homes ENERGY STAR. BOPs specify levels and limitations for the thermal envelope (insulation and windows), HVAC and water heating equipment efficiencies for a specific climate zone. BOPs require a third-party verification, including testing the leakage of the envelope and duct system, to ensure the requirements have been met. Follow these steps to build an ENERGY STAR labeled home using a BOP:

1. To find the BOP, visit the ENERGY STAR Web site at www.energystar.gov/homes. Choose the "Resources" link and click on "Builder Option Packages" under the "Support Resources" section.

2. Choose the state and county where the home will be built, and open the File. Opening the BOP files requires Adobe Acrobat Reader; a free version of Adobe Acrobat Reader can be downloaded from www.adobe.com.

3. Identify the package (i.e., BOP Number) that you are interested in building. There may be more than one page of BOPs to choose from, depending on your location. Make sure that the house you are building meets the limitations of the package. For example, if the prospective home has 16% window area, the BOP selected must meet or exceed the corresponding limitation - i.e., chose a BOP that allows </= 18% or 21% window area.

4. Build the home, following all the BOP specifications. For clarification on certain items please read the attached "Footnotes" section.

5. Contact a BOP provider to get your home inspected and labeled ENERGY STAR. BOP providers can be located on the Locator Map of the ENERGY STAR Web site at www.energystar.gov/homes.

6. The BOP provider will send a BOP inspector to verify the home meets or exceeds all requirements listed in the BOP. Verification of the home typically includes testing the air leakage of the envelope and duct system. If the home complies with the BOP, the inspector will sign and date the BOP sheet. This sheet is then filed with the BOP Providers for their records

7. For home buyers interested in an ENERGY STAR mortgage, Fannie Mae requires estimated monthly energy cost savings. For BOPs, these estimates are determined using the monthly cost savings table developed for each climate zone, such as the table below. To use this table:

   - Choose the appropriate number of stories, foundation type, and home size that most closely fits the home being built and locate the estimated monthly savings.
   - Insert the estimated monthly cost savings in the appropriate line at the bottom of the BOP sheet. Note that these estimated savings should NOT be used as basis for guaranteeing utility bills. This should only be done on a case by case basis with a qualified energy modeling tool.
   - Submit a copy of the signed BOP, which includes the estimated monthly cost savings, with your loan request forms, and indicate your interest in receiving an ENERGY STAR label.

Estimated Monthly Cost Savings Table for Climate Zone 13:																	
Number of Stories:	Single Story									Double Story								
Foundation Type:	Slab-on-grade			Basement			Crawlspace			Slab-on-grade			Basement			Crawlspace		
Home Size (SF):	1,000	2,000	2,500	1,000	2,000	2,500	1,000	2,000	2,500	2,000	4,000	5,000	2,000	4,000	5,000	2,000	4,000	5,000
Estimated Monthly Savings:	$20	$35	$40	$20	$25	$30	$25	$40	$45	$35	$70	$80	$30	$50	$70	$40	$70	$85

Builder Option Packages for ENERGY STAR® Labeled Homes[1]

EPA

Builder Name: _____

House Address: _____ City: _____ State: _____

BOP Selected	BOP Number	Climate Zone 13 [2]																	
		Window Requirements			**Minimum Insulation Requirements**[3]						**Minimum Equipment Requirements**[4]								
							Floor Above				Gas Furnace Htg / Elec Clg		Electric Htg / Electric Clg		Oil Hydronic Htg / Elec Clg		Gas Hydronic Htg / Elec Clg		
		Maximum Window Area[5]	Window U-value	Window SHGC[6]	Attic	Exterior Wall[7]	Unheated Space	Basement Wall	Slab	Crawlspace Wall	Heat (AFUE)	Cool (SEER)	Heat (HSPF)	Cool (SEER)	Heat (AFUE)	Cool (SEER)	Heat (AFUE)	Cool (SEER)
	1	12%	</= 0.35	</= 0.50	R- 38	R- 15	R- 19	R- 10	R- 6	R- 10	90%	10	--	--	82%	10	90%	10
	2	12%	</= 0.40	</= 0.40	R- 38	R- 13	R- 19	R- 10	R- 10	R- 10	90%	10	--	--	82%	10	90%	10
	3	15%	</= 0.35	</= 0.40	R- 38	R- 15	R- 19	R- 10	R- 10	R- 10	90%	10	--	--	82%	10	90%	10
	4	15%	</= 0.35	</= 0.50	R- 38	R- 19	R- 19	R- 10	R- 8	R- 10	90%	10	--	--	82%	10	90%	10
	5	18%	</= 0.35	</= 0.35	R- 38	R- 19	R- 19	R- 10	R- 8	R- 10	90%	10	--	--	82%	10	90%	10
	6	21%	</= 0.35	</= 0.35	R- 38	6.5" SIP	R- 19	R- 10	R- 8	R- 10	90%	10	--	--	82%	10	90%	10
	7	21%	</= 0.35	</= 0.35	R- 38	R-12 ICF	R- 19	R- 10	R- 10	R- 10	90%	12	--	--	82%	10	90%	12
	8	12%	</= 0.45	</= 0.50	R- 38	R- 13	R- 19	R- 10	R- 8	R- 10	94%	10	--	--	84%	10	90%	10
	9	15%	</= 0.34	</= 0.37	R- 30	R- 19	R- 19	R- 10	R- 8	R- 10	90%	10	--	--	--	--	--	--
	10	15%	</= 0.34	</= 0.37	R- 38	R- 17	R- 19	R- 10	R- 8	R- 10	90%	10	--	--	--	--	--	--
	11	15%	</= 0.35	</= 0.40	R- 38	R- 15	R- 19	R- 10	R- 8	R- 10	94%	10	--	--	84%	10	90%	10
	12	18%	</= 0.45	</= 0.50	R- 38	R- 13	R- 19	R- 10	R- 6	R- 10	--	--	2.8 COP	13 EER	86%	10	--	--
	13	21%	</= 0.35	</= 0.35	R- 38	R- 19	R- 19	R- 10	R- 8	R- 10	94%	11	--	--	84%	10	90%	11
	14	21%	</= 0.45	</= 0.45	R- 38	R- 13	R- 19	R- 10	R- 6	R- 10	--	--	2.8 COP	13 EER	88%	10	--	--

BOP Provider Company's Name: _____ BOP Provider's Address: _____

BOP Provider Phone number: _____ _____

BOP Inspector's Name: _____ BOP Inspection Company's Name: _____

Inspection Date: _____ Estimated Monthly Cost Savings:[12] _____

Version 1.1

Additional Requirements for Climate Zone 13

Envelope		Equipment					Design Limitations	
Infiltration[8]	Door	Thermostat[9]	Water Heater Energy Factor[10]	Duct Leakage[11]	Duct Insulation[12]	Ventilation	Above Grade Area per Floor	Window Orientation
</= 0.35 ac/h; blower door tested	>/= R-5	Programmable	>/= 0.56 gas; >/= 0.86 elec;	</= 6% leakage (CFM/CFM) to unconditioned spaces at 25 Pascals; field verified	Insulate ducts in unconditioned spaces to R-6	Active ventilation recommended	</= 2500 S.F.	</= 62.5% of allowable Maximum Window Area (see pg.2) can be located on the south and west

Footnotes:

1) Meeting all the requirements in a Builder Option Package (BOP) qualifies an individual home as ENERGY STAR compliant. ENERGY STAR labeled homes are designed to use at least 30% less energy than the Home Energy Rating System (HERS) Reference Home in the areas of heating, cooling, and domestic water heating. Homes that do not meet the requirements in the BOPs, should be certified by a local HERS rater. Homes built to BOP specifications must be verified by a RESNET-approved BOP provider, in accordance with the EPA/RESNET Agreement on BOPs (see www.natresnet.org/bop/agreement.htm). Additional efficiency and savings can be achieved by selecting other ENERGY STAR labeled products throughout the house (e.g., lighting, appliances). For more information, visit www.energystar.gov. Regardless of these specifications, all local codes must be followed.

2) To determine the appropriate climate zone for the building site, see the 2000 International Energy Conservation Code, Figures 302.1 (1-50).

3) Thermal requirements vary with local building codes. Ensure that insulation levels meet all relevant codes. The BOPs were developed for homes using wood framing, unless otherwise noted [i.e., insulated concrete form (ICF) or structural insulated panel (SIP)]. If metal framing is used, consult a local HERS rater to determine additional upgrades necessary to achieve similar thermal performance, such as additional insulated sheathing.
The insulation R-Value of each component (i.e., attic, exterior wall, etc.) must meet or exceed the required level designated in the BOP. The overall R-Value for components with multiple insulating levels can be determined by calculating a weighted average of the R-Values (based on the percentage of the total area each constituent covers). For example, if the attic insulation required is R-38, and 25% of the ceiling is cathedral insulated to R-19, the required R-Value for the remaining roof would be: 0.75 / [(1 / 38) - (0.25 / 19)] = 57, or R-57. Likewise, if a skylight is used as part of the roof, a similar calculation would be made using the appropriate R-values.

4) Install properly sized HVAC equipment. Recommended sizing methods: size heating & cooling equipment to ACCA Manual S specifications; size ducts to Manual D specifications, both based on Manual J load calculations. Geothermal heat pump equipment is specified in the table by a heating COP and a cooling EER.

5) Maximum window area is a ratio of total window unit area to total above-grade conditioned floor area (WFA). For example, a house with total above-grade conditioned floor area of 2,000 square feet and total window area of 400 square feet has a WFA of 400/2,000 = 20%. Regardless of the maximum window area, up to 0.5% WFA may be used for windows with decorative glass (e.g., doesn't meet U-value or SHGC requirements). Likewise, a maximum of 1.0% WFA may be used for skylights. For example, a house with total above-grade conditioned floor area of 2,000 square feet may have only 10 square feet (0.5% of 2,000) of decorative glass and 20 square feet (1% of 2,000) of skylight area. All decorative glass and skylight window area counts towards the maximum window area designated in the BOPs.

6) Solar window screens may be used to meet SHGC requirements. The overall SHGC for a window unit with solar screen is determined by the following equation: [(window SHGC) x (solar screen SHGC) x (percent of area covered)] + [window SHGC x percent of area not covered]. For example, a window with a SHGC of 0.5, using a solar screen that provides 70% shading (the equivalent of 0.3 solar heat gain coefficient) and covers 60% of the window has an overall solar heat gain coefficient of [0.5 x 0.3 x 0.6] + [0.5 x 0.4] = 0.09 + 0.20 = 0.29.

7) Insulated Concrete Form (ICF) walls must include a minimum 4" concrete thickness with minimum total form insulation of R-12. An ICF wall can be substituted for all BOPs with wall insulation levels </= R-17.
A 4.5" Structural Insulated Panel (SIP) must have an overall insulation level >/= R-15.5. A 4.5" SIP wall can be substituted for all BOPs with wall insulation levels </= R-17.

8) ASHRAE Standard 62-89 requires 0.35 ac/h of outdoor air (but not less than 15 CFM per person) to meet ventilation requirements for residential dwellings. It allows for infiltration and natural ventilation to satisfy this requirement. However, without active ventilation the actual infiltration rate could vary significantly throughout the year. To ensure consistent indoor air quality, it is recommended that homes are built to 0.20 ac/h or tighter and an active ventilation system is installed to achieve a minimum of 0.35 ac/h. To maximize savings, use a heat recovery ventilation system in cold and moderate climates, or energy recovery ventilation in hot climates.

9) Programmable thermostats used in homes with heat pumps must have "ramp-up" technology to prevent the excessive use of electric back-up heating.

10) For BOPs with Oil or Gas Hydronic equipment, domestic water heating must be provided by the space heating boiler (tankless).

11) Duct leakage is determined by: duct leakage (%) = measured leakage from portion of duct system in unconditioned space / design airflow. For example, duct leakage for a forced air system with a design airflow of 2,000 cubic feet/minute and a measured leakage to unconditioned space of 100 cubic feet/minute (CFM) is equal to 100 CFM / 2,000 CFM = 0.05, or 5%. Duct leakage tests such as the blower door subtraction method or simultaneous duct blaster and blower door testing can be used to measure duct leakage to unconditioned

12) A minimum of R-4 duct insulation is recommended for ducts in conditioned space to prevent condensation.

13) See that attached "Monthly Utility Savings" sheet to determine estimated monthly utility savings.

Notes:

a) The symbol " -- " means that the option is not available for that specific BOP.